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36. (NEW) The method of claim 20, wherein the tin-antimony alloy includes more than 10% antimony by weight.

REMARKS

Claims 1-10 and 12-36 are currently pending based on the amendment herein, wherein claims 25-29 are amended herein and claims 35-36 are new.

The Examiner objected to claims 25 and 29, alleging that “[c]laim 25 is a duplicate of claim 21 and claim 29 has two end period[s]”. In response, Applicants have amended claims 25 and 29 to clarify the invention.

The Examiner rejected claims 26-28 under 35 U.S.C. §112, second paragraph, alleging that “claims 26-28 recites the limitation ‘the joiner solder’ in lines 1. There is insufficient antecedent basis for this limitation in the claim. Note: it appears that errors have been made, it is more logical that claims 25-28 should depend from claim 24 not claim 20.” In response, Applicants have amended claims 25-28 to clarify the invention.

The Examiner stated that “[c]laims 4 and 26 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 26 should be rewritten to also overcome the rejection under 35 U.S.C. §112, 2nd paragraph. The Examiner also stated that claim 29 would be allowable if rewritten to overcome the objection for informality. Applicants gratefully acknowledge the Examiner’s indication of allowable subject matter.

The Examiner rejected claims 1-3, 5, 6, 20-23, 25, 31, and 33 under 35 U.S.C. §103(a) as being unpatentable over Kang *et al.*, YOR919950085US1 (Hereinafter Kang).

The Examiner rejected claim 28 under 35 U.S.C. §103(a) as being unpatentable over Kang, as applied to claims above, in view of Sakai *et al.*, US Patent 6077477 (hereinafter Sakai). In light of the amendment of claim 28, Applicants respectfully contend that the rejection of claim 28 is moot.

Applicants respectfully traverse the §103(a) rejections with the following arguments.

35 U.S.C. §103

The Examiner alleges that “Kang discloses a method for forming an electronic structure and inherently the structure formed by the method, the method comprising the steps of providing a substrate (solderable layer of Ni, Co, Fe...); and soldering a lead-free solder member to the substrate without using a joining solder to effectuate the soldering, wherein the solder member comprises a tin-antimony alloy that includes predominantly Sn and about 1-10% Sb by weight (See page 4); wherein the soldering step includes inherently reflowing the solder member to make it adhere to the substrate (see page 2); wherein the substrate includes a semiconductor chip (see page 2); and wherein the solder member is a solder ball (see page 2). But it does not disclose expressly the claimed range of percentage of Sb.... However, it has been shown that in the case where the claimed ranges ‘overlap or lie inside ranges disclosed by the prior art’ a *prima facie* case of obviousness exists (see MPEP 2144.05).... Therefore, it would have been obvious to use Kang’s teaching to obtain the invention as specified in claims 1-3, 6, 20, 21, and 23.”

Applicants respectfully contend that claim 1 is not unpatentable over Kang, because Kang does not teach or suggest each and every feature of claim 1. For example, Kang does not teach or suggest “soldering a lead-free solder member to the substrate without using a joining solder to

effectuate the soldering, wherein the solder member comprises a tin-antimony alloy that includes about 3% to about 15% antimony by weight.” Kang merely teaches “lead-free solder balls selectively situated on said solderable layer.” See Kang, page 4, lines 3-4. Kang does not disclose that the solder ball having the required tin-antimony composition is actually soldered to the solderable layer. Kang provides very little information and the Examiner is speculating in assuming that the solder ball in Kang is actually soldered to the solderable layer. Additionally, even if the solder ball is soldered to the solderable layer, Kang does not teach or suggest that the soldering was effectuated without the use of a joining solder between the solder ball and the solderable layer as required by claim 1. One could also speculate that the solder ball in Kang is situated on the solderable layer so as to be subsequently soldered (or otherwise attached) to the solderable layer; if so, Kang does not teach or suggest that such intended soldering will be effectuated without the use of a joining solder between the solder ball and the solderable layer as required by claim 1. Applicants respectfully contend that the Examiner has rejected claim 1 based on speculation as to whether the solder ball in Kang is soldered, or intended to be soldered, to the solderable layer. Additionally, the Examiner has not made any argument as to why it would be obvious to effectuate such soldering (if soldering is relevant in Kang) without use of a joining solder. Kang does not disclose any method steps whatsoever and the Examiner has erroneously alleged that “Kang teaches a method for forming an electronic structure.” Claim 1 in Kang clearly claims “an interconnection structure” and Kang does not even hint at a method for forming the interconnection structure. Applicants respectfully maintain that the Examiner is using hindsight reconstruction to allege that the method step of claim 1 is obvious over Kang even though Kang is totally silent as to method. Based on the preceding arguments, Applicants respectfully maintain

that claims 1 is not unpatentable over Kang, and that claim 1 is in condition for allowance. Since claims 2-3, 6, 31, and 35 depend from claim 1, Applicants contend that claims 2-3, 6, 31, and 35 are likewise in condition for allowance.

Applicants also respectfully maintain that the dependent claims have patentable features outside of their depending on claim 1. For example, claim 35 has the patentable feature of “wherein the tin-antimony alloy includes more than 10% antimony by weight”. As another example, claim 5 has the patentable feature of “wherein the substrate includes a ceramic ball grid array (CBGA) module or a plastic ball grid array (PBGA) module.” The Examiner’s argument that “including a ceramic ball grid array module or a plastic ball grid array module is widely used in the art, for efficiency” does explain why it obvious to use a CBGA or PBGA instead of the silicon chip disclosed by Kang, inasmuch as Kang’s interconnection structure (which includes the solder ball situated on the solderable layer) is for “flip-chip attachment of microelectronic device chip to packages” (as stated in claim 1 of Kang), so that substitution of a CBGA or PBGA for a chip would result in an interconnection structure lacking a chip and would thus defeat the purpose of the Kang disclosure.

Applicants respectfully contend that claim 20 is not unpatentable over Kang, because Kang does not teach or suggest each and every feature of claim 20. For example, Kang does not teach or suggest “a lead-free solder member soldered to the substrate with no joining solder between the solder member and the substrate, wherein the solder member comprises a tin-antimony alloy that includes about 3% to about 15% antimony by weight.” Kang merely teaches “lead-free solder balls selectively situated on said solderable layer.” See Kang, page 4, lines 3-4. Kang does not disclose that the solder ball having the required tin-antimony composition is

actually soldered to the solderable layer. Kang provides very little information and the Examiner is speculating in assuming that the solder ball in Kang is actually soldered to the solderable layer. Additionally, even if the solder ball is soldered to the solderable layer, Kang does not teach or suggest that the soldering there is no joining solder between the solder ball and the solderable layer as required by claim 20. One could also speculate that the solder ball in Kang is situated on the solderable layer so as to be subsequently soldered (or otherwise attached) to the solderable layer; if so, Kang does not teach or suggest that such intended soldering will result in the solder ball being soldered to the solderable layer without the use of a joining solder between the solder ball and the solderable layer as required by claim 20. Applicants respectfully contend that the Examiner has rejected claim 20 based on speculation as to whether the solder ball in Kang is soldered, or intended to be soldered, to the solderable layer. Additionally, the Examiner has not made any argument as to how Kang teaches or suggests that the solder ball is soldered to the solderable layer without use of a joining solder. Based on the preceding arguments, Applicants respectfully maintain that claims 20 is not unpatentable over Kang, and that claim 20 is in condition for allowance. Since claims 21-23, 33, and 36 depend from claim 20, Applicants contend that claims 21-23, 33, and 36 are likewise in condition for allowance.

Applicants also respectfully maintain that the dependent claims have patentable features outside of their depending on claim 20. For example, claim 36 has the patentable feature of “wherein the tin-antimony alloy includes more than 10% antimony by weight”. As another example, claim 22 has the patentable feature of “wherein the substrate includes a ceramic ball grid array (CBGA) module or a plastic ball grid array (PBGA) module.” The Examiner’s argument that “including a ceramic ball grid array module or a plastic ball grid array module is widely used

in the art, for efficiency" does explain why it obvious to use a CBGA or PBGA instead of the silicon chip disclosed by Kang, inasmuch as Kang's interconnection structure (which includes the solder ball situated on the solderable layer) is for "flip-chip attachment of microelectronic device chip to packages" (as stated in claim 1 of Kang), so that substitution of a CBGA or PBGA for a chip would result in an interconnection structure lacking a chip and would thus defeat the purpose of the Kang disclosure.

CONCLUSION

Based on the preceding arguments, Applicants respectfully believe that claims 1-10 and 12-36 meet the acceptance criteria for allowance and therefore request favorable action. If the Examiner believes that anything further would be helpful to place the application in better condition for allowance, Applicants invite the Examiner to contact Applicants' representative at the telephone number listed below.

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Appendix A. Identification of Amended Material

Please amend claims 25-29 as follows:

25. (AMENDED) The electronic structure of claim [20] 24, wherein the tin-antimony alloy includes about 5% to about 10% antimony by weight.

26. (AMENDED) The electronic structure of claim [20] 24, wherein the tin-antimony alloy is intermixed with the joiner solder.

27. (AMENDED) The electronic structure of claim [20] 24, wherein the tin-antimony alloy is not intermixed with the joiner solder.

28. (AMENDED) The electronic structure of claim [20] 24, wherein the joiner solder comprises a tin-silver-copper alloy that includes by weight about 95.5-96.0% tin, about 3.5-4.0% silver, and about 0.5-1.0% copper.

29. (AMENDED) The electronic structure of claim 24, wherein the first substrate includes a ceramic ball grid array (CBGA) module or a plastic ball grid array (PBGA) module.[.]